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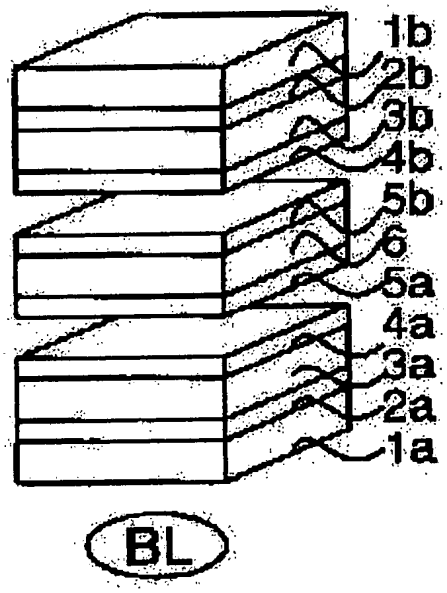
## (54) ELLIPTICALLY POLARIZING PLATE AND LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain an elliptically polarizing plate suited for TN(twisted nematic) liquid crystal cell.
SOLUTION: In an elliptic polarizing plate having a first optically anisotropic layer, a second optically anisotropic layer, a polarizing film and a transparent protection film, the first optically anisotropic layer is formed as a layer with an angle between the largest refractive index direction and the layer plane of ≥5° and <85° and the second optically anisotropic layer is formed as a layer with an angle between the largest refractive index direction and the layer plane of ≥0° and <5° and with an optically positive uniaxial property.




LEGAL STATUS

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* NOTICES *



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CLAIMS

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[Claim(s)]
[Claim 1] The elliptically-polarized-light plate with which it is the elliptically-polarized-light plate which has the 1st optical anisotropy layer, the 2nd optical anisotropy layer, the polarization film, and a transparence protective coat, and the include angle of the direction of the maximum refractive index and the field of a layer is characterized by being less than 85 degrees and 5 times or more being the layer whose include angle of the direction of the maximum refractive index and the field of a layer the 2nd optical anisotropy layer is 0 times [ less than 5 ] or more and which has optically uniaxial [ forward ] optically by the 1st optical anisotropy layer.
[Claim 2] The elliptically-polarized-light plate according to claim 1 whose 1st optical anisotropy layer is a layer formed from the cylindrical liquid crystallinity molecule.
[Claim 3] The elliptically-polarized-light plate according to claim 2 from which the tilt angle of a cylindrical liquid crystallinity molecule is changing in connection with the distance of a cylindrical liquid crystallinity molecule and the 2nd optical anisotropy stratification plane.
[Claim 4] The elliptically-polarized-light plate according to claim 1 whose 2nd optical anisotropy layer is the polymer film which carried out uniaxial stretching.
[Claim 5] The elliptically-polarized-light plate according to claim 1 whose 2nd optical anisotropy layer is the cellulose ester film which carried out uniaxial stretching.
[Claim 6] The elliptically-polarized-light plate according to claim 1 which lies at right angles substantially in the same side of the direction which projected the direction of the maximum refractive index of the 1st optical anisotropy layer on the field of a layer, and the direction of the maximum refractive index of the 2nd optical anisotropy layer.
[Claim 7] The elliptically-polarized-light plate according to claim 1 with which the laminating of the 1st optical anisotropy layer, the 2nd optical anisotropy layer, the polarization film, and the transparence protective coat is carried out in this sequence.
[Claim 8] The elliptically-polarized-light plate according to claim 1 with which the direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film lie at right angles substantially in the same field.
[Claim 9] The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film are an parallel elliptically-polarized-light plate according to claim 1 substantially in the same side.
[Claim 10] It is the liquid crystal display which consists of two polarizing plates arranged at a TN liquid crystal cel and its both sides. At least one side of a polarizing plate The 1st optical anisotropy layer, the 2nd optical anisotropy layer, It has the polarization film and a transparence protective coat, and the 1st optical anisotropy layer is [ the include angle of the direction of the maximum refractive index and the field of a layer ] 5 times [ less than 85 ] or more. The liquid crystal display with which the 2nd optical anisotropy layer is characterized by being the elliptically-polarized-light plate which is the layer which is less than 5 times, and which has optically uniaxial [ forward ] optically by the include angle of the direction of the maximum refractive index, and the field of a layer 0 times or more.

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[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a elliptically-polarized-light plate and a liquid crystal display.
[0002]
[Description of the Prior Art] TN (Twisted Nematic) mold liquid crystal display is a liquid crystal display most widely used combining an active element like TFT (Thin Film Transistor) or MIM (Metal Insulator Metal). A TN liquid crystal display consists of a TN liquid crystal cel and a polarizing element of two sheets. A liquid crystal cell consists of an electrode layer for applying an electrical potential difference to two substrates and cylindrical liquid crystallinity molecule for enclosing a cylindrical liquid crystallinity molecule and it. In a TN liquid crystal cel, the orientation film for carrying out orientation of the cylindrical liquid crystallinity molecule by 90-degree angle of torsion is prepared in two substrates. In order to improve the angle of visibility of a TN liquid crystal display, generally an optical compensation sheet (phase contrast plate) is prepared between a liquid crystal cell and a polarizing element. The layered product of a polarizing element (polarization film) and an optical compensation sheet functions as a elliptically-polarized-light plate. As an optical compensation sheet, the extension birefringence film is used from the former.
[0003] Replacing with the optical compensation sheet which consists of an extension birefringence film, and using the optical compensation sheet which has an optical anisotropy layer containing a liquid crystallinity molecule on a transparence base material is proposed. An optical anisotropy layer carries out orientation of the liquid crystallinity molecule, and is formed by fixing the orientation condition. Generally a liquid crystallinity molecule has a big rate of a birefringence. By using a liquid crystallinity molecule, the conventional extension birefringence film enables it to manufacture the optical compensation sheet which has the optical property which cannot be obtained. About the optical compensation sheet for TN liquid crystal cels using a discotheque liquid crystallinity molecule, each specification (JP,6-214116,A, a U.S. Pat. No. 5583679 number, said 5646703 numbers, and German JP,3911620,B A1 No.) has a publication. Moreover, about the optical compensation sheet for TN liquid crystal cels using a cylindrical liquid crystallinity molecule, JP,7-35924,A has a publication.
[0004]
[Problem(s) to be Solved by the Invention] The purpose of this invention is offering the elliptically-polarized-light plate suitable for a TN liquid crystal display.
[0005]
[Means for Solving the Problem] The purpose of this invention was attained by the liquid crystal display of following the (1) - (the elliptically-polarized-light plate of 7), and following (10).
(1) The elliptically-polarized-light plate with which it is the elliptically-polarized-light plate which has the 1st optical anisotropy layer, the 2nd optical anisotropy layer, the polarization film, and a transparence protective coat, and the include angle of the direction of the maximum refractive index and the field of a layer is characterized by being less than 85 degrees and 5 times or more being the layer whose include angle of the direction of the maximum refractive index and the

field of a layer the 2nd optical anisotropy layer is 0 times [ less than 5 ] or more, which has optically uniaxial [ forward ] optically by the 1st optical anisotropy layer.
(2) A elliptically-polarized-light plate given in (1) whose 1st optical anisotropy layer is a layer formed from the cylindrical liquid crystallinity molecule.
(3) A elliptically-polarized-light plate given in (2) from which the tilt angle of a cylindrical liquid crystallinity molecule is changing in connection with the distance of a cylindrical liquid crystallinity molecule and the 2nd optical anisotropy stratification plane.
(4) A elliptically-polarized-light plate given in (1) whose 2nd optical anisotropy layer is the polymer film which carried out uniaxial stretching.
(5) A elliptically-polarized-light plate given in (1) whose 2nd optical anisotropy layer is the cellulose ester film which carried out uniaxial stretching.
(6) A elliptically-polarized-light plate given in (1) which lies at right angles substantially in the same side of the direction which projected the direction of the maximum refractive index of the 1st optical anisotropy layer on the field of a layer, and the direction of the maximum refractive index of the 2nd optical anisotropy layer.
(7) A elliptically-polarized-light plate given in (1) to which the laminating of the 1st optical anisotropy layer, the 2nd optical anisotropy layer, the polarization film, and the transparence protective coat is carried out in this sequence.
(8) A elliptically-polarized-light plate given in (1) to which the direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film lie at right angles substantially in the same field.
(9) The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film are a elliptically-polarized-light plate given in parallel (1) substantially in the same side.
(10) It is the liquid crystal display which consists of two polarizing plates arranged at a TN liquid crystal cel and its both sides. At least one side of a polarizing plate The 1st optical anisotropy layer, the 2nd optical anisotropy layer, It has the polarization film and a transparence protective coat, and the 1st optical anisotropy layer is [ the include angle of the direction of the maximum refractive index and the field of a layer ] 5 times [ less than 85 ] or more. The liquid crystal display with which the 2nd optical anisotropy layer is characterized by being the elliptically-polarized-light plate which is the layer which is less than 5 times, and which has optically uniaxial [ forward ] optically by the include angle of the direction of the maximum refractive index, and the field of a layer 0 times or more. In addition, a rectangular cross or parallel means substantially that angular difference with a strict rectangular cross or an parallel condition is less than **20 degrees. It is more desirable that it is less than **12 degrees, it is desirable that it is less than **16 degrees, and it is [ as for angular difference, it is still more desirable that it is less than **8 degrees, and ] most desirable that it is less than **4 degrees.
[0006]
[Embodiment of the Invention] Drawing 1 is the mimetic diagram showing the fundamental configuration of a TN liquid crystal display. The TN liquid crystal indicating equipment shown in drawing 1 sequentially from a back light (BL) side A transparence protective coat (1a), the polarization film (2a), the 2nd optical anisotropy layer (3a), It consists of the 1st optical anisotropy layer (4a), the bottom substrate of a liquid crystal cell (5a), a cylindrical liquid crystallinity molecule (6), the upper substrate (5b) of a liquid crystal cell, the 1st optical anisotropy layer (4b), the 2nd optical anisotropy layer (3b), polarization film (2b), and a transparence protective coat (1b). The bottom substrate of a liquid crystal cell, a cylindrical liquid crystallinity molecule, and the upper substrate (5a-5b) of a liquid crystal cell constitute a TN liquid crystal cel. The 1st optical anisotropy layer and the 2nd optical anisotropy layer (3a-4a, and 4b-3b) constitute an optical compensation sheet. A transparence protective coat, the polarization film, the 1st optical anisotropy layer, and the 2nd optical anisotropy layer (1a-4a, and 4b-1b) constitute a elliptically-polarized-light plate.
[0007] Drawing 2 is the mimetic diagram showing another fundamental configuration of a TN liquid crystal display. The TN liquid crystal indicating equipment shown in drawing 2 sequentially from a back light (BL) side It consists of a transparence protective coat (1a), the polarization

film (2a), the 2nd optical anisotropy layer (3a), the 1st optical anisotropy layer (4a), the bottom substrate of a liquid crystal cell (5a), a cylindrical liquid crystallinity molecule (6), the upper substrate (5b) of a liquid crystal cell, a transparence protective coat (1b), polarization film (2b), and a transparence protective coat (1c). The bottom substrate of a liquid crystal cell, a cylindrical liquid crystallinity molecule, and the upper substrate (5a-5b) of a liquid crystal cell constitute a TN liquid crystal cel. The 1st optical anisotropy layer and the 2nd optical anisotropy layer (3a-4a) constitute an optical compensation sheet. A transparence protective coat, the polarization film, the 1st optical anisotropy layer, and the 2nd optical anisotropy layer (1a-4a) constitute a elliptically-polarized-light plate.

[0008] Drawing 3 is the mimetic diagram showing still more nearly another fundamental configuration of a TN liquid crystal display. The TN liquid crystal indicating equipment shown in drawing 3 sequentially from a back light (BL) side It consists of a transparence protective coat (1a), the polarization film (2a), a transparence protective coat (1b), the bottom substrate of a liquid crystal cell (5a), a cylindrical liquid crystallinity molecule (6), the upper substrate (5b) of a liquid crystal cell, the 1st optical anisotropy layer (4b), the 2nd optical anisotropy layer (3b), polarization film (2b), and a transparence protective coat (1c). The bottom substrate of a liquid crystal cell, a cylindrical liquid crystallinity molecule, and the upper substrate (5a-5b) of a liquid crystal cell constitute a TN liquid crystal cel. The 1st optical anisotropy layer and the 2nd optical anisotropy layer (4b-3b) constitute an optical compensation sheet. A transparence protective coat, the polarization film, the 1st optical anisotropy layer, and the 2nd optical anisotropy layer (4b-1c) constitute a elliptically-polarized-light plate. As shown in drawing 1 -3, as for a elliptically-polarized-light plate, it is desirable that the laminating of the 1st optical anisotropy layer, the 2nd optical anisotropy layer, the polarization film, and the transparence protective coat is carried out in this sequence. As for the elliptically-polarized-light plate, the laminating of the 2nd optical anisotropy layer, the 1st optical anisotropy layer, the polarization film, and the transparence protective coat may be carried out in this sequence.

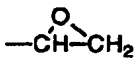
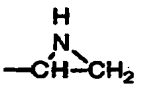
[0009] The include angle of the direction of the maximum refractive index and the field of a layer of the 1st optical anisotropy layer of the [1st optical anisotropy layer] is 5 times [ less than 85 ] or more. As for the 1st optical anisotropy layer, it is desirable to be able to form from the liquid crystallinity molecule or the polymer film which carried out slanting extension which carried out slanting orientation, and especially to form the 1st optical anisotropy layer from a cylindrical liquid crystallinity molecule by this invention. When the cylindrical liquid crystallinity molecule is carrying out orientation to homogeneity, the direction of a major axis of a molecule corresponds in the maximum refractive-index direction. Therefore, when forming the 1st optical anisotropy layer from a cylindrical liquid crystallinity molecule, the average tilt angle (average include angle of a cylindrical liquid crystallinity molecule and the field of a layer) of a cylindrical liquid crystallinity molecule is made into less than 85 degrees 5 times or more. As for the tilt angle of a cylindrical liquid crystallinity molecule, it is desirable to change in connection with the distance of a cylindrical liquid crystallinity molecule and the 2nd optical anisotropy stratification plane.

[0010] As a cylindrical liquid crystallinity molecule, azomethines, AZOKISHI, cyano biphenyls, cyanophenyl ester, benzoates, cyclohexane-carboxylic-acid phenyl ester, cyanophenyl cyclohexanes, cyano permutation phenyl pyrimidines, alkoxy permutation phenyl pyrimidines, phenyl dioxanes, tolan, and alkenyl cyclohexyl benzonitriles are used preferably. In addition, a metal complex is also contained in a cylindrical liquid crystallinity molecule. About a cylindrical liquid crystallinity molecule, Chapter 4 edited by the Quarterly Chmistry Survey, No. 22, The Chemistry of Liquid Crystals (1994) Chemical Society of Japan, Chapter 7, Chapter 11, and Chapter 3 for 142nd committee of liquid crystal device handbook Japan Society for the Promotion of Science have a publication. As for the rate of a birefringence of a cylindrical liquid crystallinity molecule, it is desirable that it is 0.001 thru/or 0.7. As for a cylindrical liquid crystallinity molecule, it is desirable to have a polymerization nature machine. The example of a polymerization nature machine (Q) is shown below.

[0011]

[Formula 1]

(Q1) —CH=CH$_2$ (Q2) —CH=CH—CH$_3$ (Q3) —CH=CH—C$_2$H$_5$ (Q4) —CH=CH—n-C$_3$H$_7$

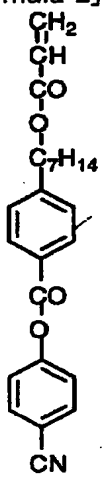
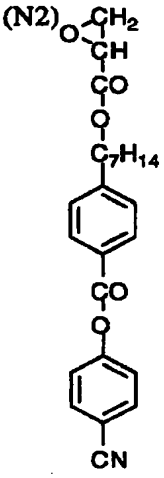
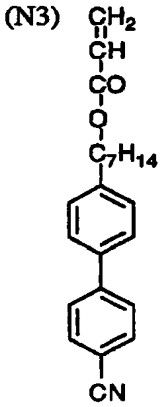
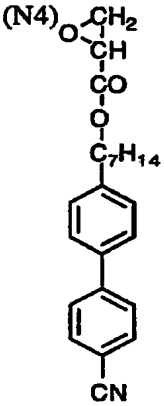
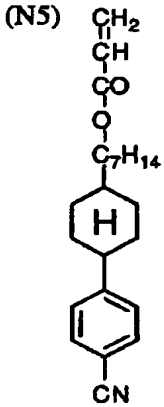
(Q5) —C(CH$_3$)=CH$_2$ (Q6) —CH=C(CH$_3$)—CH$_3$ (Q7) —C≡CH (Q8)  (Q9)  (Q10) —SH

(Q11) —CHO (Q12) —OH (Q13) —CO$_2$H (Q14) —N=C=O (Q15) —NH$_2$ (Q16) —SO$_3$H (Q-17) —N=C=S

[0012] It is desirable that they are a partial saturation polymerization nature machine (Q1-Q7), an epoxy group (Q8), or an aziridinyl radical (Q9), as for a polymerization nature machine (Q), it is still more desirable that it is a partial saturation polymerization nature machine, and it is most desirable that it is an ethylene nature partial saturation polymerization nature machine (Q1-Q6). Below, the example of a polymerization nature cylindrical liquid crystallinity molecule is shown.

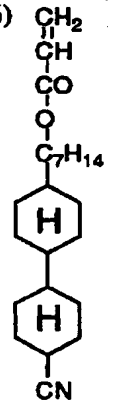
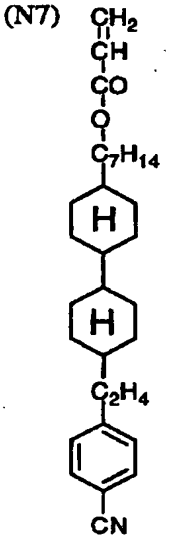
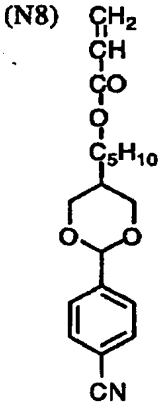
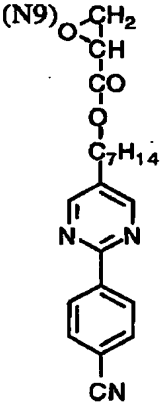
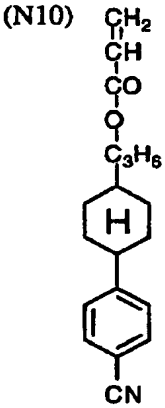
[0013]

[Formula 2]

(N1)  (N2)  (N3)  (N4)  (N5) 

[0014]

[Formula 3]

(N6)  (N7)  (N8)  (N9)  (N10) 

[0015]

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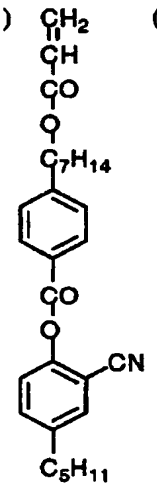
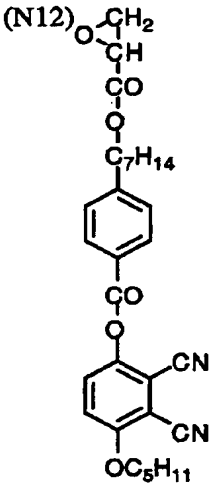
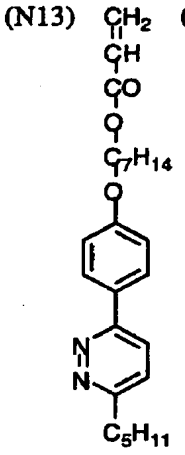
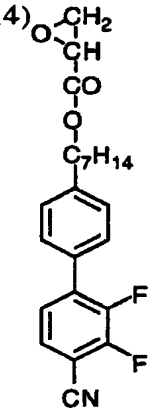
(N11) 

(N12) 

(N13) 

(N14) 

[0016]

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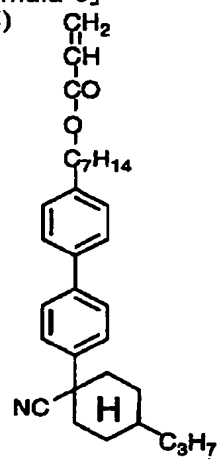
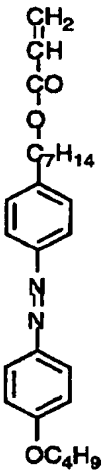
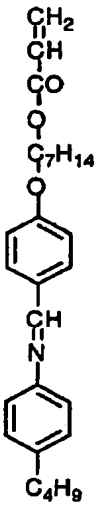
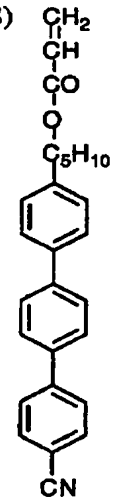
(N15) 

(N16) 

(N17) 

(N18) 

[0017]

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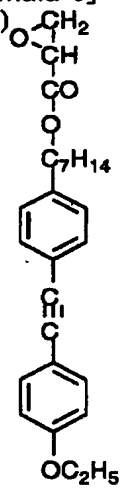
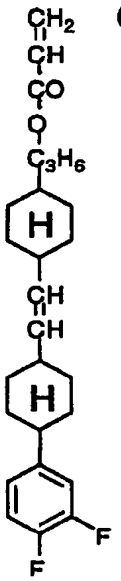
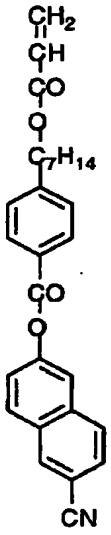
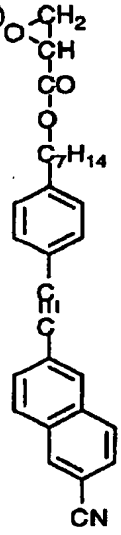
(N19) 

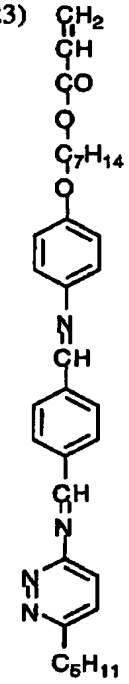
(N20) 

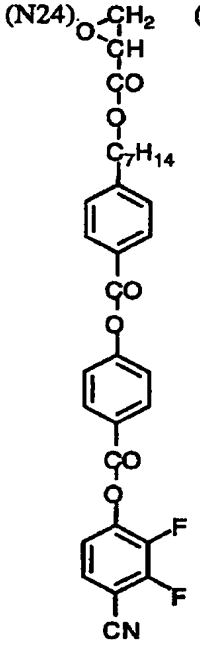
(N21) 

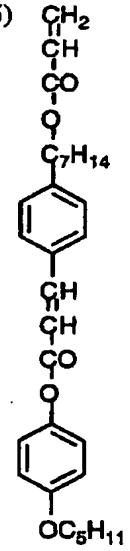
(N22) 

[0018]

[Formula 7]

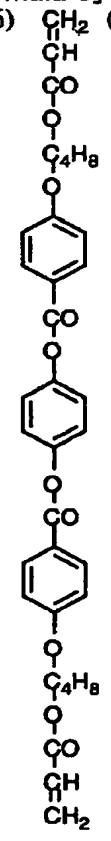
(N23) 

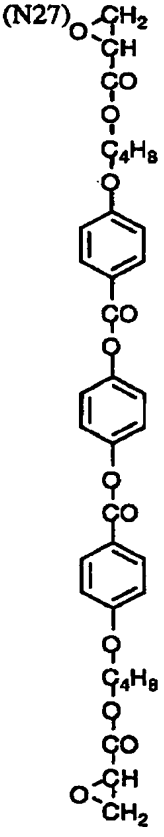
(N24) 

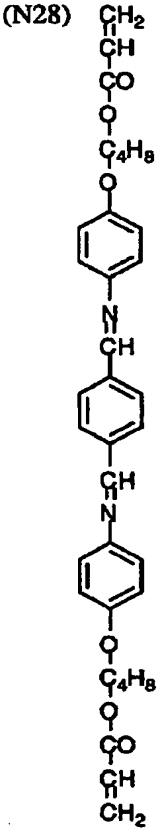
(N25) 

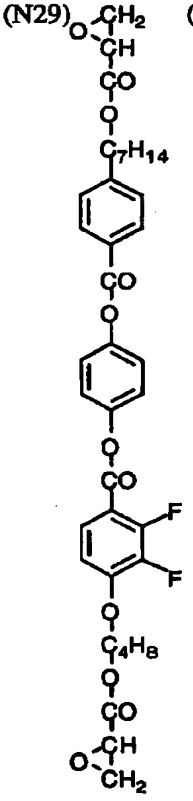
[0019]

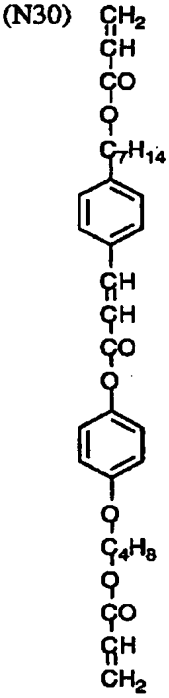
[Formula 8]

(N26) 

(N27) 

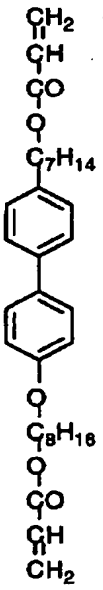
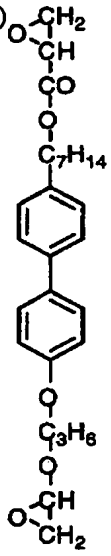
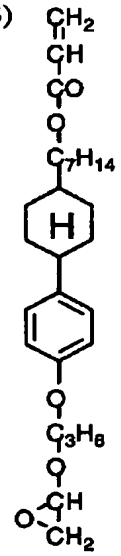
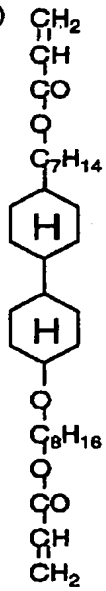
(N28) 

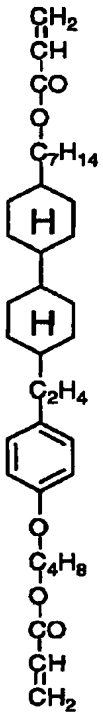
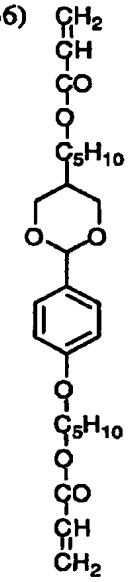
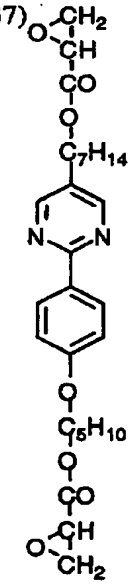
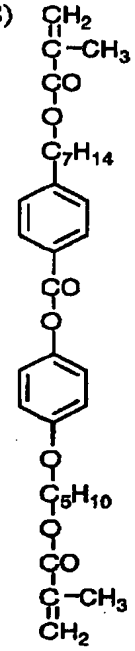
(N29) 

(N30) 

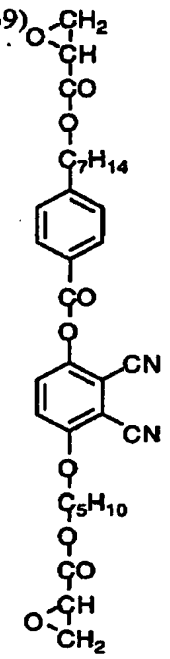
[0020]

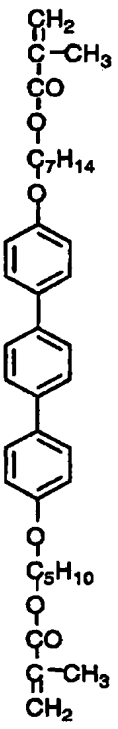
[Formula 9]

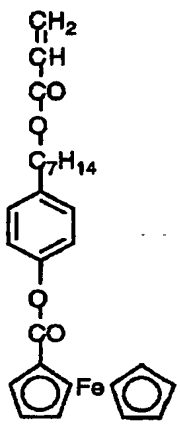
(N31)  (N32)  (N33)  (N34) 

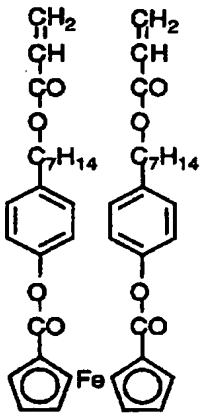
[0021]
[Formula 10]
(N35)  (N36)  (N37)  (N38) 

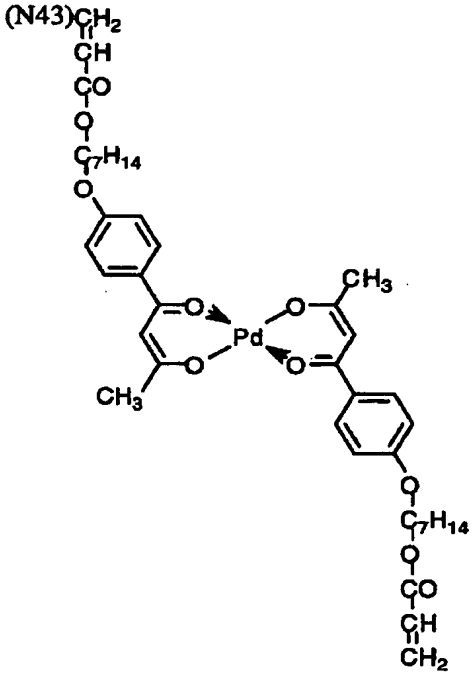
[0022]
[Formula 11]

(N39) 

(N40) 

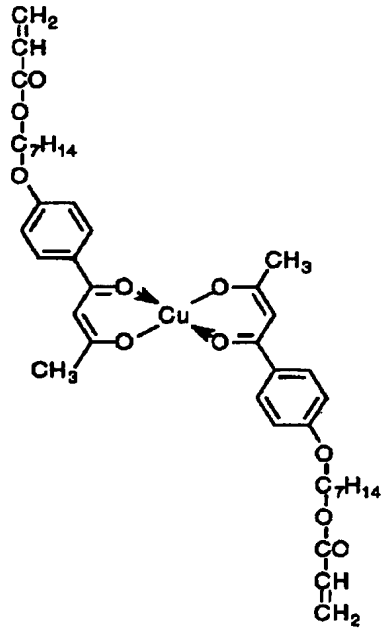
(N41) 

[0023]
[Formula 12]
(N42) 

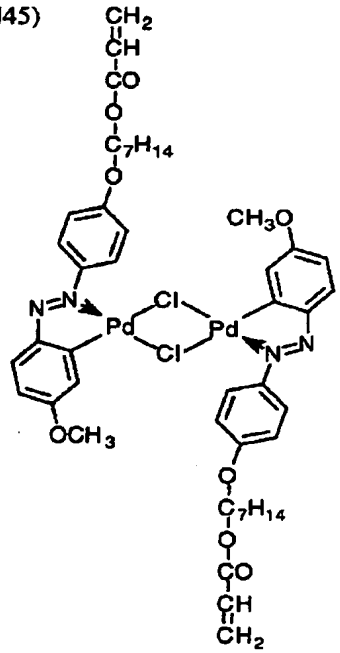
(N43) 

[0024]
[Formula 13]

(N44)



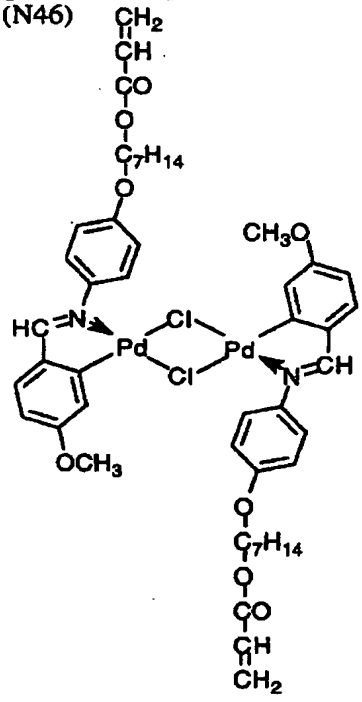
(N45)



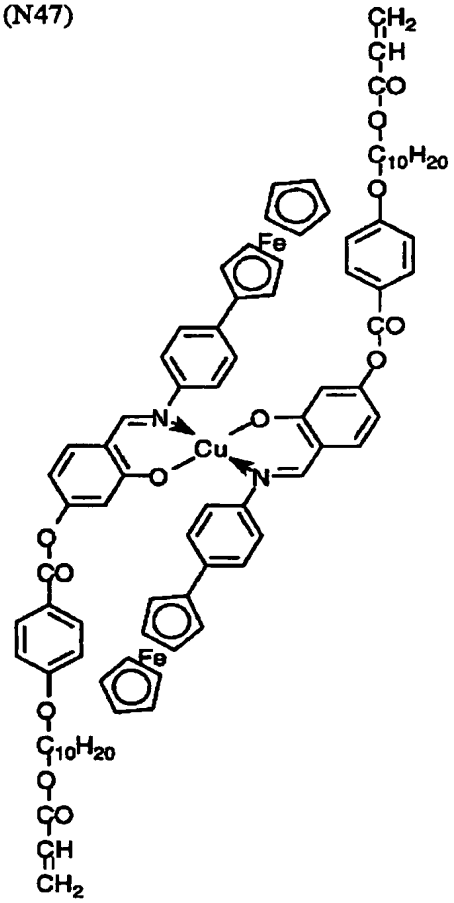
[0025]

[Formula 14]

(N46)



(N47)



[0026] Two or more kinds of cylindrical liquid crystallinity molecules may be used together. For example, a polymerization nature cylindrical liquid crystallinity molecule and a non-polymerization nature cylindrical liquid crystallinity molecule can be used together. The 1st optical anisotropy layer forms the liquid crystal constituent (coating liquid) containing a cylindrical liquid crystallinity molecule or the following polymerization nature initiator, or the additive (an example, a

plasticizer, a monomer, a surfactant, cellulose ester) of arbitration by applying on the orientation film. As a solvent used for preparation of a liquid crystal constituent, an organic solvent is used preferably. An amide (an example, N.N-dimethylformamide), a sulfoxide (an example, dimethyl sulfoxide), a heterocycle compound (an example, pyridine), a hydrocarbon (an example, benzene, hexane), alkyl halide (an example, chloroform, dichloromethane), ester (an example, methyl acetate, butyl acetate), a ketone (an example, an acetone, methyl ethyl ketone), and the ether (an example, a tetrahydrofuran, 1, 2-dimethoxyethane) are contained in the example of an organic solvent. Alkyl halide and a ketone are desirable. Two or more kinds of organic solvents may be used together. Spreading of a liquid crystal constituent can be carried out by the well-known approach (an example, a wire bar coating method, an extrusion coating method, the direct gravure coating method, the reverse gravure coating method, die coating method).

[0027] It is desirable to carry out orientation to homogeneity substantially, as for a cylindrical liquid crystallinity molecule, it is still more desirable to be fixed in the condition of carrying out orientation to homogeneity substantially, and it is most desirable that the liquid crystallinity molecule is being fixed by the polymerization reaction. The thermal polymerization reaction which uses a thermal polymerization initiator, and the photopolymerization reaction using a photopolymerization initiator are included in a polymerization reaction. A photopolymerization reaction is desirable. the example of a photopolymerization initiator -- alpha-carbonyl compound (a U.S. Pat. No. 2367661 number --) Each specification publication of said 2367670 numbers, the acyloin ether (U.S. Pat. No. 2448828 number specification publication), alpha-hydrocarbon permutation aromatic series acyloin compound (U.S. Pat. No. 2722512 number specification publication), a polykaryotic quinone compound (a U.S. Pat. No. 3046127 number -- said -- each specification publication of No. 2951758) -- The combination of a thoria reel imidazole dimer and p-aminophenyl ketone (U.S. Pat. No. 3549367 number specification publication), An acridine, a phenazine compound (JP,60-105667,A, U.S. Pat. No. 4239850 number specification publication), and an oxadiazole compound (U.S. Pat. No. 4212970 number specification publication) are contained. As for the amount of the photopolymerization initiator used, it is desirable that they are 0.01 of the solid content of coating liquid thru/or 20 % of the weight, and it is still more desirable that they are 0.5 thru/or 5 % of the weight. As for the optical exposure for the polymerization of a cylindrical liquid crystallinity molecule, it is desirable to use ultraviolet rays. exposure energy -- 20 mJ/cm2 Or 50 J/cm2 it is -- things -- desirable -- 100 thru/or 800 mJ/cm2 it is -- things are still more desirable. In order to promote a photopolymerization reaction, an optical exposure may be carried out under heating conditions. It is desirable that they are 0.1 thru/or 20 micrometers, as for the thickness of the 1st optical anisotropy layer, it is still more desirable that they are 0.5 thru/or 15 micrometers, and it is most desirable that they are 1 thru/or 10 micrometers.

[0028] The 2nd optical anisotropy layer of the [2nd optical anisotropy layer] is a layer whose include angle of the direction of the maximum refractive index and the field of a layer is 0 times [ less than 5 ] or more and which has optically uniaxial [ forward ] optically. In addition, as for the direction which projected the direction of the maximum refractive index of the 1st optical anisotropy layer on the field of a layer, and the direction of the maximum refractive index of the 2nd optical anisotropy layer, it is desirable to make it intersect perpendicularly substantially in the same side. The 2nd optical anisotropy layer can be formed from the cylindrical liquid crystallinity molecule or the polymer film extended horizontally which carried out level orientation. It is desirable to form the 2nd optical anisotropy layer from an extension polymer film, especially the polymer film which carried out uniaxial stretching.

[0029] Generally as a polymer which forms the 2nd optical anisotropy layer, cellulose ester (an example, cellulose acetate) or a synthetic polymer (an example, a polycarbonate, polysulfone, polyether sulphone, polyacrylate, polymethacrylate, norbornene resin) is used. It is desirable to use a cellulose ester film, a polycarbonate film, or a norbornene resin film in the 2nd optical anisotropy layer, and especially the thing for which a cellulose ester film is used is desirable. In addition, generally the cellulose ester film is known as a polymer film with the high (a retardation is low) optical isotropy. However, the high cellulose ester film (optical anisotropy) of a retardation can be obtained by the fall of whenever [ use / of (1) retardation rise agent indicated by the

Europe JP,091165656,B A No. 2 specification /, and acetylation / of (2) cellulose acetate ], or manufacture of the film by (3) cooling solution process. As for a polymer film, forming by the solvent cast method is desirable.

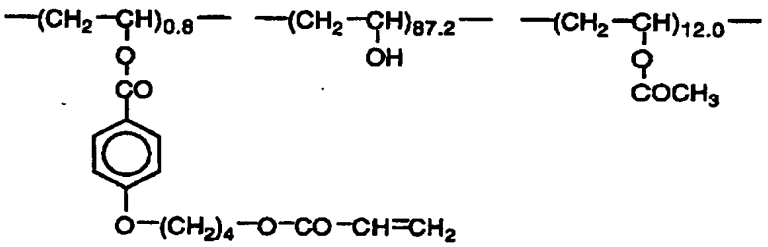
[0030] The formed polymer film acquires an optical anisotropy by generally extending. That is, by uniaxial-stretching processing, it has optically uniaxial [ forward ] optically and the direction of the maximum refractive index can obtain an parallel polymer film substantially with a stratification plane. As for uniaxial stretching, it is desirable to carry out to the lengthwise direction (the flow casting direction) of a film. Weak extension processing (imbalance biaxial-stretching processing) may be carried out also to the direction (when the direction of uniaxial stretching is the flow casting direction of a film, it is the cross direction of a film) which intersects perpendicularly in the direction of uniaxial stretching. As for the thickness of the 2nd optical anisotropy layer which consists of a polymer film, it is desirable that they are 20 thru/or 500 micrometers, and it is still more desirable that they are 50 thru/or 200 micrometers. In order to improve adhesion with the 2nd optical anisotropy layer which consists of a polymer film, and the layer (a glue line, the orientation film, or the 1st optical anisotropy layer) prepared on it, surface treatment (an example, glow discharge processing, corona discharge treatment, ultraviolet-rays (UV) processing, flame treatment) may be carried out in the 2nd optical anisotropy layer. A glue line (under coat) may be prepared on the 2nd optical anisotropy layer.

[0031] When forming the 2nd optical anisotropy layer from a cylindrical liquid crystallinity molecule, it is desirable to prepare the 2nd optical anisotropy layer of the top using a transparence base material (or on the orientation film prepared on it). As a transparence base material, a cellulose ester film is desirable. When forming the 2nd optical anisotropy layer from a cylindrical liquid crystallinity molecule, the average tilt angle (average include angle of a cylindrical liquid crystallinity molecule and the field of a layer) of a cylindrical liquid crystallinity molecule is made into less than 5 times 0 times or more. About the detail of cylindrical liquid crystallinity molecules other than an average tilt angle, it is the same as that of the 1st optical anisotropy layer. It is desirable that they are 0.1 thru/or 20 micrometers, as for the thickness of the 2nd optical anisotropy layer formed from a cylindrical liquid crystallinity molecule, it is still more desirable that they are 0.5 thru/or 15 micrometers, and it is most desirable that they are 1 thru/or 10 micrometers.

[0032] Orientation of the cylindrical liquid crystallinity molecule used for the 1st optical anisotropy layer of the [orientation film] or the 2nd optical anisotropy layer is carried out using the orientation film. The orientation film is a means like accumulation of the organic compound (an example, omega-tricosane acid, dioctadecyl methylanmmonium chloride, stearyl acid methyl) by rubbing processing of an organic compound (preferably polymer), the method vacuum evaporationo of slanting of an inorganic compound, formation of the layer which has a micro groove, or the Langmuir-Blodgett's technique (LB film), and can be prepared. Furthermore, the orientation film which an orientation function produces is also known by grant of electric field, grant of a magnetic field, or optical exposure. Especially the orientation film formed by rubbing processing of a polymer is desirable. Rubbing processing is carried out by rubbing the front face of a polymer layer several times in the fixed direction with paper or cloth. It is desirable to use the polymer (the usual polymer for orientation film) to which surface energy of the orientation film is not reduced as a polymer which constitutes the orientation film. As for the thickness of the orientation film, it is desirable that they are 0.01 thru/or 5 micrometers, and it is still more desirable that they are 0.05 thru/or 1 micrometer. In addition, since orientation of the cylindrical liquid crystallinity molecule of the 1st optical anisotropy layer or the 2nd optical anisotropy layer is carried out using the orientation film, an optical anisotropy layer may be imprinted on the 2nd optical anisotropy layer or a transparence base material. Even if the cylindrical liquid crystallinity molecule fixed in the state of orientation does not have the orientation film, it can maintain an orientation condition.

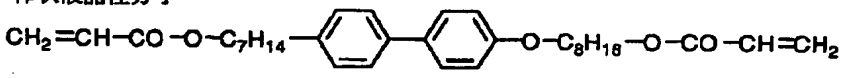
[0033] There are iodine system polarization film, and the color system polarization film and polyene system polarization film which use dichromatic dye as [polarization film] polarization film. Generally the iodine system polarization film and the color system polarization film are manufactured using a polyvinyl alcohol system film. The polarization shaft of the polarization film

corresponds in the direction perpendicular to the extension direction of a film.
[0034] A polymer film is used as a [transparence protective coat] transparence protective coat. It means that light transmittance is 80% or more as a protective coat is transparent. as a transparence protective coat -- general -- a cellulose ester film -- a triacetyl cellulose film is used preferably. As for a cellulose ester film, forming by the solvent cast method is desirable. As for the thickness of a transparence protective coat, it is desirable that they are 20 thru/or 500 micrometers, and it is still more desirable that they are 50 thru/or 200 micrometers.
[0035] [Liquid crystal display] this invention is applicable to the liquid crystal cell of various display modes. However, especially this invention is effective in the liquid crystal display in TN (Twisted Nematic) mode.
[0036]
[Example] [Example 1]
(Formation of the 2nd optical anisotropy layer) The cellulose acetate solution which consists of the following presentation was prepared, and the cellulose acetate film whose desiccation thickness is 105 micrometers was manufactured using the drum flow casting machine.
[0037]
---------- cellulose acetate solution presentation ---------- Whenever [ average acetylation ] 60.9% of cellulose acetate 45 mass sections SUMISORUBU TM 165 (Sumitomo Chemical Co., Ltd. make) The 2.35 mass sections Triphenyl phosphate The 2.75 mass sections Phosphoric-acid biphenyl diphenyl The 2.20 mass sections Methylene chloride The 232.75 mass sections Methanol 42.57 mass section n-butanol 8.50 mass sections ---------- [0038] The manufactured cellulose acetate film was extended at 60% of real scale factors, and the 2nd optical anisotropy layer was formed. When the retardation in the wavelength of 633nm was measured using the ellipsomter (M150, Jasco Corp. make), the retardation (Rth) of the thickness direction was [ 85nm and the retardation within a field (Re) ] 100nm.
[0039] (Formation of the 1st optical anisotropy layer) The gelatin layer was prepared in one side of the 2nd optical anisotropy layer. On the gelatin layer, the coating liquid which consists of the following presentation was applied, and the orientation film with a thickness of 0.5 micrometers was formed.
---------- orientation film coating liquid presentation ---------- The following denaturation polyvinyl alcohol Two mass sections Glutaraldehyde The 0.1 mass section Water 98 mass sections ---------- [0040]
[Formula 15]
変性ポリビニルアルコール



[0041] Rubbing processing of the orientation film front face was carried out. On the orientation film, the coating liquid which consists of the following presentation was applied, and the 1st optical anisotropy layer with a thickness of 1.5 micrometers was formed.
[0042]
---------- The 1st optical anisotropy layer coating liquid presentation ---------- The following cylindrical liquid crystallinity molecule 30 mass sections Methylene chloride 70 mass sections ---------- [0043]
[Formula 16]

棒状液晶性分子



[0044] When the retardation value in the wavelength of 633nm was measured using the ellipsomter (M150, Jasco Corp. make), the retardation (Rth) of the thickness direction was 100nm. Moreover, the include angle of the direction and stratification plane from which a refractive index serves as min was 50 degrees.

[0045] (Production of a elliptically-polarized-light plate) Iodine was made to stick to the extended polyvinyl alcohol film, and the polarization film was produced. One side of the polarization film and the 2nd optical anisotropy stratification plane of the produced optical compensation sheet were stuck using polyvinyl alcohol system adhesives. The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film have been arranged so that it may intersect perpendicularly. It was stuck on the field of the opposite side of the polarization film using polyvinyl alcohol system adhesives, having used the triacetyl cellulose film (FUJITAKKU, Fuji Photo Film Co., Ltd. make) with a thickness of 100 micrometers as the transparence protective coat. Thus, the elliptically-polarized-light plate was produced.

[0046] (Production of a liquid crystal display) The polyimide orientation film was prepared on the glass substrate with which the ITO transparent electrode was prepared, and rubbing processing was performed. Through the 4.5-micrometer spacer, two substrates were piled up so that the orientation film might face each other. Two substrates have been arranged so that the direction of rubbing of the orientation film may intersect perpendicularly. The cylindrical liquid crystallinity molecule (ZLI-4792, Merck Co. make) was poured into the gap of a substrate, and the cylindrical liquid crystal layer was formed in it. The produced elliptically-polarized-light plate was stuck on the both sides of TN liquid crystal cell produced as mentioned above so that two sheets and an optical anisotropy layer might meet a substrate, and the liquid crystal display was produced. The direction of rubbing of the orientation film and the direction of rubbing of the orientation film of the liquid crystal cell which adjoins it have been arranged so that it may become anti-parallel. When the produced TN liquid crystal display was investigated, contrast was good and the good image without reversal of gradation was displayed.

[0047] [Example 2]

(Formation of the 2nd optical anisotropy layer) The norbornene resin solution which consists of the following presentation was prepared, and the norbornene resin whose desiccation thickness is 100 micrometers was manufactured using the band casting machine.

[0048]

---------- ---------- norbornene resin solution presentation ---------- ---------- ---------- norbornene resin (ARTON, product made from JSR) 30 mass sections Methylene chloride 70 mass sections ---------- [0049] The manufactured norbornene resin film was extended at 30% of real scale factors to the longitudinal direction, it extended at 15% of real scale factors crosswise further, and the 2nd optical anisotropy layer was formed. When the retardation value in the wavelength of 633nm was measured using the ellipsomter (M150, Jasco Corp. make), the retardation (Rth) of the thickness direction was [ 85nm and the retardation within a field (Re) ] 100nm.

[0050] (Formation of the 1st optical anisotropy layer) Corona discharge treatment of one side of the 2nd optical anisotropy layer was carried out, and the orientation film and the 1st optical anisotropy layer were formed like the example 1 on it. Optical property is shown in the 1st table.

[0051] (Production of a elliptically-polarized-light plate) Iodine was made to stick to the extended polyvinyl alcohol film, and the polarization film was produced. One side of the polarization film and the 2nd optical anisotropy stratification plane of the produced optical compensation sheet were stuck using polyvinyl alcohol system adhesives. The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film have been arranged so that it may intersect perpendicularly. It was stuck on the field of the opposite side of the polarization film using polyvinyl alcohol system adhesives, having

used the triacetyl cellulose film (FUJITAKKU, Fuji Photo Film Co., Ltd. make) with a thickness of 100 micrometers as the transparence protective coat. Thus, the elliptically-polarized-light plate was produced.

[0052] (Production of a liquid crystal display) The polyimide orientation film was prepared on the glass substrate with which the ITO transparent electrode was prepared, and rubbing processing was performed. Through the 4.5-micrometer spacer, two substrates were piled up so that the orientation film might face each other. Two substrates have been arranged so that the direction of rubbing of the orientation film may intersect perpendicularly. The cylindrical liquid crystallinity molecule (ZLI-4792, Merck Co. make) was poured into the gap of a substrate, and the cylindrical liquid crystal layer was formed in it. The produced elliptically-polarized-light plate was stuck on the both sides of TN liquid crystal cell produced as mentioned above so that two sheets and an optical anisotropy layer might meet a substrate, and the liquid crystal display was produced. The direction of rubbing of the orientation film and the direction of rubbing of the orientation film of the liquid crystal cell which adjoins it have been arranged so that it may become anti-parallel. When the produced TN liquid crystal display was investigated, contrast was good and the good image without reversal of gradation was displayed.

[0053] [Example 3]

(Formation of the 2nd optical anisotropy layer) The commercial polycarbonate film (Teijin, Ltd. make) was extended at 30% of real scale factors to the longitudinal direction, and the 2nd optical anisotropy layer was formed. When the retardation value in the wavelength of 633nm was measured using the ellipsomter (M150, Jasco Corp. make), the retardation (Rth) of the thickness direction was [ 100nm and the retardation within a field (Re) ] 150nm.

[0054] (Formation of the 1st optical anisotropy layer) Corona discharge treatment of one side of the 2nd optical anisotropy layer was carried out, and the orientation film and the 1st optical anisotropy layer were formed like the example 1 on it. Optical property is shown in the 1st table.

[0055] (Production of a elliptically-polarized-light plate) Iodine was made to stick to the extended polyvinyl alcohol film, and the polarization film was produced. One side of the polarization film and the 2nd optical anisotropy stratification plane of the produced optical compensation sheet were stuck using polyvinyl alcohol system adhesives. The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film have been arranged so that it may intersect perpendicularly. It was stuck on the field of the opposite side of the polarization film using polyvinyl alcohol system adhesives, having used the triacetyl cellulose film (FUJITAKKU, Fuji Photo Film Co., Ltd. make) with a thickness of 100 micrometers as the transparence protective coat. Thus, the elliptically-polarized-light plate was produced.

[0056] (Production of a liquid crystal display) The polyimide orientation film was prepared on the glass substrate with which the ITO transparent electrode was prepared, and rubbing processing was performed. Through the 4.5-micrometer spacer, two substrates were piled up so that the orientation film might face each other. Two substrates have been arranged so that the direction of rubbing of the orientation film may intersect perpendicularly. The cylindrical liquid crystallinity molecule (ZLI-4792, Merck Co. make) was poured into the gap of a substrate, and the cylindrical liquid crystal layer was formed in it. The produced elliptically-polarized-light plate was stuck on the both sides of TN liquid crystal cell produced as mentioned above so that two sheets and an optical anisotropy layer might meet a substrate, and the liquid crystal display was produced. The direction of rubbing of the orientation film and the direction of rubbing of the orientation film of the liquid crystal cell which adjoins it have been arranged so that it may become anti-parallel. When the produced TN liquid crystal display was investigated, contrast was good and the good image without reversal of gradation was displayed.

[0057] [Example 4]

(Formation of the 1st optical anisotropy layer) The coating liquid which becomes one side of the 2nd optical anisotropy layer produced in the example 1 from the photopolymerization nature oligomer (UN900PEP, product made from Neagari Industry) 1 mass section, the tetrahydrofuran 19 mass section, and a small amount of benzophenone was applied, and it dried for 30 minutes at 60 degrees C. while impressing at the include angle which moreover applied the cylindrical

pneumatic liquid crystal nature child (ZL 14788-100, Merck Japan make), and leaned [ of the spreading side ] the magnetic field of 5kG 70 degrees in the direction perpendicular to the extension direction of the 2nd optical anisotropy layer from the normal -- an ultraviolet ray lamp -- ultraviolet rays -- irradiating -- a cylindrical pneumatic liquid crystal nature child -- orientation -- and it fixed. Optical property is shown in the 1st table.

[0058] (Production of a elliptically-polarized-light plate) Iodine was made to stick to the extended polyvinyl alcohol film, and the polarization film was produced. One side of the polarization film and the 2nd optical anisotropy stratification plane of the produced optical compensation sheet were stuck using polyvinyl alcohol system adhesives. The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film have been arranged so that it may intersect perpendicularly. It was stuck on the field of the opposite side of the polarization film using polyvinyl alcohol system adhesives, having used the triacetyl cellulose film (FUJITAKKU, Fuji Photo Film Co., Ltd. make) with a thickness of 100 micrometers as the transparence protective coat. Thus, the elliptically-polarized-light plate was produced.

[0059] (Production of a liquid crystal display) The polyimide orientation film was prepared on the glass substrate with which the ITO transparent electrode was prepared, and rubbing processing was performed. Through the 4.5-micrometer spacer, two substrates were piled up so that the orientation film might face each other. Two substrates have been arranged so that the direction of rubbing of the orientation film may intersect perpendicularly. The cylindrical liquid crystallinity molecule (ZLI-4792, Merck Co. make) was poured into the gap of a substrate, and the cylindrical liquid crystal layer was formed in it. The produced elliptically-polarized-light plate was stuck on the both sides of TN liquid crystal cell produced as mentioned above so that two sheets and an optical anisotropy layer might meet a substrate, and the liquid crystal display was produced. The direction of rubbing of the orientation film and the direction of rubbing of the orientation film of the liquid crystal cell which adjoins it have been arranged so that it may become anti-parallel. When the produced TN liquid crystal display was investigated, contrast was good and the good image without reversal of gradation was displayed.

[0060] [Example 5]

(Formation of the 2nd optical anisotropy layer) The triacetyl cellulose film (FUJITAKKU, Fuji Photo Film Co., Ltd. make) was used as a transparence base material. The gelatin layer was prepared in one side of a transparence base material. On the gelatin layer, the coating liquid which consists of the following presentation was applied, and the orientation film with a thickness of 0.5 micrometers was formed.

---------- orientation film coating liquid presentation ---------- ---------- denaturation polyvinyl alcohol (MP203, Kuraray Co., Ltd. make) Two mass sections Glutaraldehyde The 0.1 mass section Water 98 mass sections ---------- ---------- [0061] Rubbing processing of the orientation film front face was carried out. On the orientation film, the coating liquid which consists of the following presentation was applied, and the 2nd optical anisotropy layer with a thickness of 1.5 micrometers was formed.

[0062]

---------- The 2nd optical anisotropy layer coating liquid presentation ---------- The cylindrical liquid crystallinity molecule used in the 1st optical anisotropy layer of the example 1 30 mass section Methylene chloride 70 mass sections ---------- [0063] When the retardation in the wavelength of 633nm was measured using the ellipsomter (M150, Jasco Corp. make), the retardation (Rth) of the thickness direction was [ 100nm and the retardation within a field (Re) ] 150nm.

[0064] (Formation of the 1st optical anisotropy layer) A gelatin layer, the orientation film, and the 1st optical anisotropy layer were formed in the field of the opposite side of a transparence base material like the example 1. Optical property is shown in the 1st table.

[0065] (Production of a elliptically-polarized-light plate) Iodine was made to stick to the extended polyvinyl alcohol film, and the polarization film was produced. One side of the

polarization film and the 2nd optical anisotropy stratification plane of the produced optical compensation sheet were stuck using polyvinyl alcohol system adhesives. The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film have been arranged so that it may intersect perpendicularly. It was stuck on the field of the opposite side of the polarization film using polyvinyl alcohol system adhesives, having used the triacetyl cellulose film (FUJITAKKU, Fuji Photo Film Co., Ltd. make) with a thickness of 100 micrometers as the transparence protective coat. Thus, the elliptically-polarized-light plate was produced.

[0066] (Production of a liquid crystal display) The polyimide orientation film was prepared on the glass substrate with which the ITO transparent electrode was prepared, and rubbing processing was performed. Through the 4.5-micrometer spacer, two substrates were piled up so that the orientation film might face each other. Two substrates have been arranged so that the direction of rubbing of the orientation film may intersect perpendicularly. The cylindrical liquid crystallinity molecule (ZLI-4792, Merck Co. make) was poured into the gap of a substrate, and the cylindrical liquid crystal layer was formed in it. The produced elliptically-polarized-light plate was stuck on the both sides of TN liquid crystal cell produced as mentioned above so that two sheets and an optical anisotropy layer might meet a substrate, and the liquid crystal display was produced. The direction of rubbing of the orientation film and the direction of rubbing of the orientation film of the liquid crystal cell which adjoins it have been arranged so that it may become anti-parallel. When the produced TN liquid crystal display was investigated, contrast was good and the good image without reversal of gradation was displayed.

[0067]

[Table 1]

The 1st table ---------- the 1st optical anisotropy layer The 2nd optical anisotropy layer the -- elliptically-polarized-light plate of the 1+ 2nd layered product Whenever [ refractive-index maximum vectorial angle ] Whenever [ refractive-index maximum vectorial angle ] Whenever [ refractive-index minimum vectorial angle ] ---------- ---------- The example 1 45 degrees 0 degree 50 degrees Example 2 45 degrees 0 degree The 50-degree example 3 35 degrees 0 degree 60 degrees Example 4 55 degrees 0 degree 40 degrees Example 5 25 degrees 0 degree 70degree ---------- ------ [0068] [Example 6]

(Formation of the 2nd optical anisotropy layer) It stirred having fed the following constituent into the mixing tank and heating it, and the cellulose acetate solution which becomes since each component is dissolved was prepared.

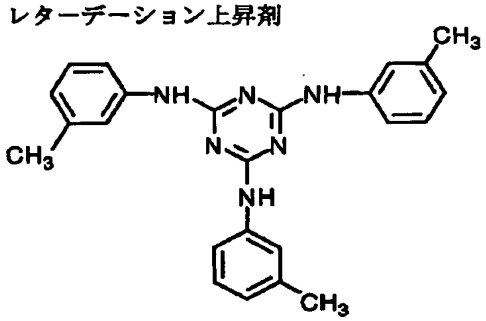
[0069]

---------- cellulose acetate solution presentation ---------- ---------- Whenever [ acetylation ] 60.0% of cellulose acetate The 100 mass sections Triphenyl phosphate (plasticizer) The 7.8 mass sections Biphenyl diphenyl phosphate (plasticizer) The 3.9 mass sections Methylene chloride (the 1st solvent) The 300 mass sections Methanol (the 2nd solvent) 54 mass section 1-butanol (the 3rd solvent) Eleven mass sections -- ---------- [0070] It stirred supplying and heating the following retardation rise agent 16 mass section, the methylene-chloride 80 mass section, and the methanol 20 mass section on another mixing tank, and the retardation rise agent solution was prepared.

[0071]

[Formula 17]

レターデーション上昇剤



[0072] In the cellulose acetate solution 474 mass section, the retardation rise agent solution 56 mass section was mixed, it fully stirred in it, and the dope was prepared in it. The obtained dope was cast using the band casting machine. Horizontal extension of the film whose amount of residual solvents is 15 % of the weight was carried out by 35% of draw magnification using the tenter on 30-degree C conditions, and the cellulose acetate film was manufactured. When the retardation value in the wavelength of 550nm was measured using the ellipsomter (M150, Jasco Corp. make) about the 2nd optical anisotropy layer which consists of a manufactured cellulose acetate film, the retardation (Rth) of the thickness direction was [ 130nm and the retardation within a field (Re) ] 105nm. After being immersed in the 1.5-N potassium-hydroxide water solution for 5 minutes at 40 degrees C, the sulfuric acid neutralized the 2nd optical anisotropy layer, and it rinsed with pure water, and dried. It was 68 mN/m when asked for the surface energy of the 2nd optical anisotropy layer by the contact angle method.
[0073] (Formation of the 1st optical anisotropy layer) The wire bar coating machine of #16 is used for the coating liquid which becomes one side of the 2nd optical anisotropy layer from the following presentation, and it is 28 ml/m2. It applied. It dried for 150 seconds by 90 more-degree C warm air for 60 seconds by 60-degree C warm air.
[0074]
---------- orientation film coating liquid presentation ---------- The denaturation polyvinyl alcohol used in the example 1 Ten mass sections Water The 371 mass sections Methanol The 119 mass sections Glutaraldehyde (cross linking agent) 0.5 mass sections ---------- [0075] In the direction which intersects perpendicularly with the lagging axis (it measures on the wavelength of 632.8nm) of the 2nd optical anisotropy layer, rubbing processing of the orientation film front face was carried out. On the orientation film, the 1st optical anisotropy layer coating liquid used in the example 1 was applied, and the 1st optical anisotropy layer with a thickness of 1.5 micrometers was formed. When the retardation in the wavelength of 633nm was measured using the ellipsomter (M150, Jasco Corp. make), the retardation (Rth) of the thickness direction was 100nm. Moreover, the include angle of the direction and stratification plane from which a refractive index serves as min was 50 degrees.
[0076] (Production of a elliptically-polarized-light plate) Iodine was made to stick to the extended polyvinyl alcohol film, and the polarization film was produced. One side of the polarization film and the 2nd optical anisotropy stratification plane of the produced optical compensation sheet were stuck using polyvinyl alcohol system adhesives. The direction of the maximum refractive index of the 2nd optical anisotropy layer and the transparency shaft of the polarization film have been arranged so that it may become parallel. It was stuck on the field of the opposite side of the polarization film using polyvinyl alcohol system adhesives, having used the triacetyl cellulose film (FUJITAKKU, Fuji Photo Film Co., Ltd. make) with a thickness of 100 micrometers as the transparence protective coat. Thus, the elliptically-polarized-light plate was produced.
[0077] (Production of a liquid crystal display) The polyimide orientation film was prepared on the glass substrate with which the ITO transparent electrode was prepared, and rubbing processing was performed. Through the 4.5-micrometer spacer, two substrates were piled up so that the orientation film might face each other. Two substrates have been arranged so that the direction

of rubbing of the orientation film may intersect perpendicularly. The cylindrical liquid crystallinity molecule (ZLI-4792, Merck Co. make) was poured into the gap of a substrate, and the cylindrical liquid crystal layer was formed in it. The produced elliptically-polarized-light plate was stuck on the both sides of TN liquid crystal cell produced as mentioned above so that two sheets and an optical anisotropy layer might meet a substrate, and the liquid crystal display was produced. The direction of rubbing of the orientation film and the direction of rubbing of the orientation film of the liquid crystal cell which adjoins it have been arranged so that it may become anti-parallel. When the produced TN liquid crystal display was investigated, contrast was good and the good image without reversal of gradation was displayed.

[0075]

[Effect of the Invention] If the elliptically-polarized-light plate of this invention is used, contrast is good and can display a good image with little tone reversal.

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[Translation done.]

* NOTICES *



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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram showing the fundamental configuration of a TN liquid crystal display.
[Drawing 2] It is the mimetic diagram showing another fundamental configuration of a TN liquid crystal display.
[Drawing 3] It is the mimetic diagram showing still more nearly another fundamental configuration of a TN liquid crystal display.
[Description of Notations]
BL Back light
1a, 1b, 1c Transparence protective coat
2a, 2b Polarization film
3a, 3b The 2nd optical anisotropy layer
4a, 4b The 1st optical anisotropy layer
5a Bottom substrate of a liquid crystal cell
5b The upper substrate of a liquid crystal cell
6 Cylindrical Liquid Crystallinity Molecule

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[Translation done.]

* NOTICES *



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DRAWINGS

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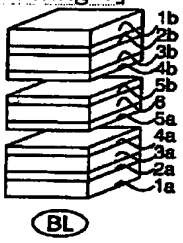
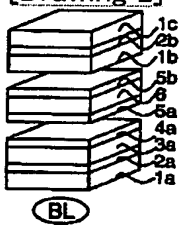
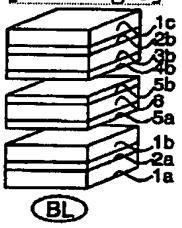
[Drawing 1]




[Drawing 2]




[Drawing 3]

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[Translation done.]